AD-A154 350 AUTOMATED DENTAL EPIDEMIOLOGY SYSTEM III DATA SYSTEM DESIGN(U) NAVAL DENTAL RESEARCH INST GREAT LAKES IL M C DIEHL OCT 84 NDRI-PR-84-07 1/1

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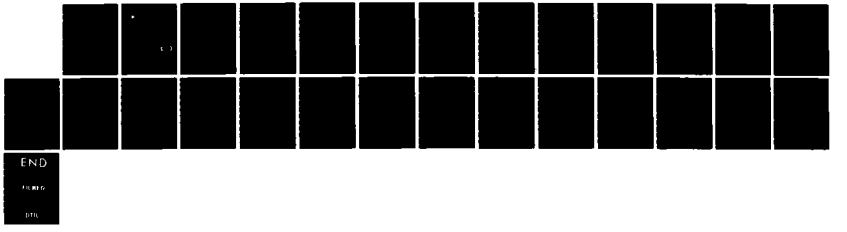

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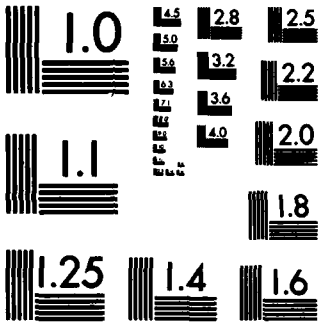

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

NDRI-PR 84-07
OCTOBER 1984

AUTOMATED DENTAL EPIDEMIOLOGY SYSTEM: III. DATA SYSTEM DESIGN

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Research Progress Report NDRI-PR 84-07
Work Unit M0095.003-3028
Naval Medical Research and Development Command
Naval Medical Command, National Capital Region
Bethesda, Maryland 20814

Approved and released by:

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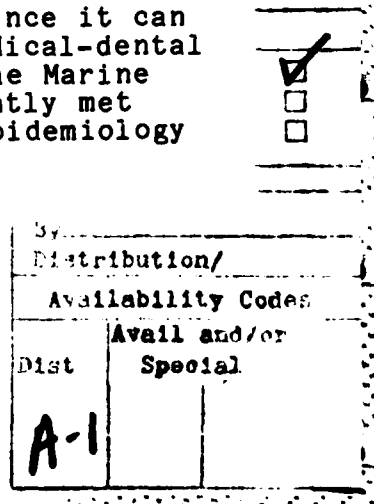
BACKGROUND

The primary objective of the automated dental epidemiology system is to gather and process data which accurately describes the oral health of Navy and Marine Corps personnel. The resultant oral health profiles would be useful to identify the nature and extent of dental and periodontal diseases in the active duty population. This system could rapidly determine specific treatment needs of both individuals and groups, and could follow the long term efficacy of treatment modalities, materials and devices. This approach, when conducted throughout the entire Navy and Marine Corps, would enable optimum dental service planning on both the strategic and operational levels. As a primary result, the Navy Medical Command and its dental professionals would be able to more effectively prevent and treat dental disease and dental emergencies in the military population.

Previous publications covered the preliminary investigation, systems analysis and functional design phases of an automated dental epidemiology system (1-3). Several changes in the system's operational environment have occurred since the preparation of the functional design. These changes require a modification of the approach to data capture and processing. The possibility of these changes was anticipated in the preparation of the functional design (2). Therefore, modification of the functional design requires only a transition to a previously considered alternative.

Recent advances in microcomputer technology, in particular the performance of peripheral devices, make stand-alone microcomputer-based units a low cost and high performance alternative to multiprocessing, using a large host computer. The use of distributed processing in the automated epidemiology system is especially attractive in view of the adoption of Navy Industrial Fund (NIF) procedures by the Data Automation Command (NARDAC) data processing services. This attractiveness will continue as the trend toward increased capability and reduced cost of microcomputer technology continues.

There is need for compatability between the automated dental system and other Navy Medical Command computer applications. In particular, compatibility is desired with the Marine Corps combat casualty information system and other automated medical applications of the Naval Health Research Center, San Diego. The Naval Health Research Center (NHRC) has developed sophisticated techniques to evaluate medical data based on the use of ANSI MUMPS language and the COSTAR medical data base system (4). Compatability with NHRC methodologies is advantageous since it can provide considerably enhanced research through joint medical-dental record automation. The need to encode dental data in the Marine Corps combat casualty information system can be efficiently met using automated techniques compatible with the dental epidemiology system (5).



Compatibility is important from other operational aspects. Access to a comprehensive dental epidemiology system by dental activities serving operational units can provide a ready source of replacement records. It can be an accurate source of dental data to aid forensic identification such as by the techniques developed by the Navy, and subsequently investigated by the Army (6,7). Likewise, this system can be a major data source for management either directly through inclusion of management information applications or indirectly as a data input to a management information system (MIS).

FUNCTIONAL DESIGN MODIFICATIONS

Except for increased compatiblity, the requirements specified for the prototype automated dental epidemiology system remain unchanged from those previously identified (2). The guideline of expeditiously developing the needed information with minimal clinical disruption remains constant despite changes in the clinical and data processing environment (6,7). Likewise, the general pattern of information flow and the resultant data processing modules remain unchanged.

In light of these changes, the widespread use of microcomputers, cited as approach number 3 of the functional design, becomes the most attractive alternative (2). Several architectures for microcomputer employment in the clinical setting were evaluated. The most appropriate of these, from cost-performance criteria, is the use of stand-alone microcomputer units located in clinical areas. Relatively inexpensive microcomputer equipment supporting advanced technology peripheral devices for data capture is readily available in the computer marketplace. Use of this equipment genre is considerably more cost effective than on-line processing under Navy Industrial Fund (NIF) constraints. The absence of on-line capability to reference a master file, however, does not readily permit identity verification during inprocessing. Data compilation in the clinic after the examination process may become a more cumbersome task compared to centralized data processing linked to an automated personnel system. The subsequent editing and updating of the central data file may likewise require a more strenuous design effort. The benefits of on-line capability, however, are greatly outweighed by the considerable expense for system operation under NIF.

The cost of epidemiology processing and data base operations under NIF is likewise prohibitive compared to the cost of these operations being conducted on a dedicated minicomputer located in-house at the Naval Dental Research Institute (NDRI). For the immediate operation of the system, dental data files are to be maintained on a statistical minicomputer with an appropriate data dictionary and schema (8). As dental data on increasing numbers of patients is maintained and data input expands to include other facilities, the size of the dental data base will greatly increase. A bulk data storage capacity will be required. This demand for

increased storage capacity may be accomplished in-house at NDRI by increasing the data storage capacity available on a dedicated minicomputer or by using data storage at the Data Automation Facility (NAVDAF) at Great Lakes. Considering the annual cost of using external data storage under NIF, employment of high capacity data storage onboard NDRI is the more economical alternative.

The resultant functional design is illustrated in Figure 1. The principal modification in the new functional design is that the on-line terminal network is replaced by a group of independent microcomputer-based data capture units. Clinical data capture for both the inprocessing examination and subsequent dental services provided are to be accomplished as originally designed (2). Initially, during testing and prove-in procedures, a single microcomputer station would be located at the Dental Clinic Headquarters. Subsequently, appropriate data processing techniques will become available for the individual clinics using small microcomputer units. These clinical microcomputer stations may be linked to the headquarters unit by electronic and/or physical data transfer as required by individual operating needs.

In this functional design, the Dental Clinic Headquarters is the focal point for all local activities. Dental records are to be computer generated at the recruit inprocessing facility and transferred to the recruit treatment clinic as currently accomplished in the Navy recruit training centers. Electronic examination data is to be passed to the Headquarters, where treatment-need reports are to be prepared. These reports, for example those detailing individual and group treatment needs, are to be forwarded to the recruit treatment clinic for use in service planning. Treatment data is to be forwarded from all clinics to the Headquarters. This treatment data can be processed for administrative purposes in the Headquarters and can be used for data input to a management information system (MIS).

Examination and treatment data can be developed at any clinical facility and managed in an identical manner. Thus the same examination data capture methods could be used for annual dental examinations (i.e., dental recall) in the field or fleet support environment. Treatment-need reports could be developed for specific operational units in an identical manner. Treatment and examination data are to be subsequently forwarded from all dental activities to NDRI for epidemiology processing and bulk data storage. As the capabilities of this approach are subsequently exploited, there will be likely use of Department of Defense data-communications links between NDRI and the Dental Clinic Headquarters echelon for direct transfer of examination, treatment and records data. Thus there will be the ability to employ completely automated dental record procedures which would facilitate personnel management and provide for rapid, efficient replacement of missing dental records.

SYSTEM DESIGN

The system design is developed by mating computer technology to those information requirements identified in the functional design. Selective expansion and elaboration of the concepts developed in the functional design are employed to produce an information flowchart. Information flowcharts for the automated system are illustrated in Figures 2 through 4, and described subsequently in this text. These flowcharts are design tools which satisfy the information requirements in both the recruit environment and for the dental services of operational naval units. From these flowcharts, data flow diagrams (DFD) are used to detail the data processing procedures and subsequently to specify equipment (9).

Table I lists the microcomputer-based data capture technologies which were evaluated for clinical applications. Of these technologies, the touch-sensitive devices appeared to provide the greatest utility for recording the dental examination. For recording dental services rendered, only the mark-sense card reader appeared well suited for all clinical applications and situations. The touch-sensitive tablet, the touch screen and the custom keyboard appeared, however, to offer advantages for recording treatment data in specific clinical environments. Many Naval Dental Clinics are presently automating administrative services with Zenith microcomputer equipment available through federal procurement. With the sole exception of unique clinical data capture operations, all applications developed for this system are intended to be fully operable on this equipment.

A touch-sensitive application was developed for automated recording of the dental inprocessing examination (10,11). For this application, both touch-sensitive monitor and tablet devices were examined. A 6502 microprocessor based microcomputer was selected since this computer type economically meets the operational requirements of this application and both data capture devices are readily supported by the microcomputer architecture and operating systems. For the prototype application development and testing, commercially available equipment was selected. For actual clinical operations, a mobile data capture unit is to be designed based on the results of prototype testing. Access to each examination data capture unit will be controlled by keyed switch. An uninterruptable power supply will provide operating security in the event of electrical fluctuation. The unit is to be designed for efficient operation and to minimize operator fatigue.

For the recruit inprocessing clinic at Naval Dental Clinic, Great Lakes, five of these mobile units are to be used for recording dental inprocessing examination data. By using mobile units, the data capture equipment can be easily assigned to examination operatories as required by daily operations. Subsequently, additional examination units can be assigned to those operatories conducting annual examinations for staff personnel (i.e., dental recall).

The data capture program is to be written in Floating Point BASIC and compiled to maximize operating speed. Both touch-screen and touch-tablet application programs are to be prepared to compare clinical utility. The touch-screen application is to be prepared as a logical sequence of component modules which smoothly follows the course of dental examination. Provision is to be made for the following examination components:

1. a health history review
2. a regional examination (facial and mucosal structures)
3. an occlusal examination
4. a periodontal and prosthetic needs survey
5. a recording of existing restorations and missing teeth and
6. a recording of dental and periodontal pathology.

Where the touch-screen is to use a sequence of individual displays, the touch tablet is to have the entire content of the dental examination displayed on a single overlay sheet.

After the oral examinations are completed on a group of recruit personnel, the examination findings are to be recalled for review and treatment planning by the examining dental officer. Upon completion of each case review, the computer will print a dental record document using a preprinted automated equivalent of the SF-603 dental record form, Figure 5. Simultaneously, the computer will make a permanent recording of the examination findings on a floppy disk. Each data disk will contain approximately 70 examination records. Given current operating levels, this capacity is sufficient to meet the data entry needs of a single data capture unit at full utilization for one day in both recruit inprocessing and annual examination operations.

Individual dental records are to be assembled as each automated SF-603 examination form is completed. Disposition of the completed dental records will then follow existing operational practices. For the recruit setting this typically involves bulk transfer of recruit dental record documents to the DENCLIN ANNEX RECRUIT central records area. The data from each data capture unit are to be forwarded daily to the Dental Clinic Headquarters, and subsequently to NDRI. This transfer may be accomplished via physical transfer of disk media and/or electronic data transmission via land line.

At the Headquarters, the examination data are to be processed for the preparation of reports among which are descriptions of individual, group and critical care treatment needs. The group treatment-need report describes numbers of patient sittings, treatment procedures and estimated treatment time requirements for priority and routine patients within the recruit company or

operational unit. A profile of that unit by dental class is also included, as illustrated in Figure 6. Individual treatment needs (Figure 7) identify specific treatment needs of individuals within the group. The treatment needs are rank-ordered from minimal to extensive for both the priority and routine patient groups. This permits the dental triage officer to provide service to a maximum number of patients, and effect a maximum number of patients converted to Class 1 condition. This report can be used to identify personnel within a specific group, for example, the Dental Class 3 patients in a given operational unit, and thus target them for immediate care. Critical treatment-need reports (Figure 8) are likewise prepared for both routine and priority patients; these reports identify those patients in urgent need of treatment for existing or immediately impending infection or pain. Optional reports to be available as desired include a listing of specialty consultations required per company (Figure 9), and a listing of those personnel in the company having a dentally significant medical history (Figure 10). A provision for generation of custom reports designed by clinical and managerial personnel is required to be responsive to local needs.

Treatment data is to be entered into the system via mark-sense cards (12). These cards are to be completed by the dental officers (or technicians at their direction) as the dental-services-provided entries are made on the SF-603 dental record form. Cards listing treatment procedures for general dental practice (Figure 11) and for each of the dental specialties are to be available as needed. In addition, a utility card listing procedural codes (such as the DOD standard dental codes) is to be available for uncommon treatment entries. An administrative card may be used to facilitate clinical management functions. The data cards are intended to function with a minimum of recording activity, thus paralleling the data entry practices found in the most streamlined civilian dental management systems.

Upon completion, each card is to be inserted into the patient's dental record for return to clinic central records area (in some cases these will be retained by the dental officer and submitted at the end of the work day). For medico-legal reasons, the dental officer's signature and date should be required on each card. Cards are to be removed and collected at the central records area. The dental records officer or person in charge of the clinic central records area may compare card entries to the treatment entry noted on the SF-603 form. This assures a single, verifiable and intact audit trail. All treatment cards are to be collected and forwarded to the Dental Clinic Headquarters for processing. Cards reporting treatment provided to recruits during inprocessing will be read prior to preparation of treatment-need reports, so that those reports will provide an accurate listing of treatment needs expected at the Recruit Treatment Annex.

These cards are to be read in the clinic records area and/or in the DENCLIN Headquarters using an optical card reader (13). This card reader may be interfaced directly to numerous

microcomputers, including the federal procurement Zenith microcomputer. Data obtained from these cards would be sufficient to develop dental management information and to prepare local management reports on demand. Typical of the management reports may be treatment delivery (productivity) reports for each dental officer, treatment clinic and Dental Clinic totals. A daily treatment-provided log may be provided to each dental officer (Figure 12).

Since no keyboard data entry will be required either at the Headquarters or in the clinic, those personnel normally assigned this function will be available for other assignments. The management information, developed per local needs, will be available to be routed through the chain of command as appropriate for each dental clinic, shipboard dental department or field dental service (FMF or NMCB). Both hard-copy data (reports) and electronic data (disk files) may be maintained by the Dental Clinic Headquarters. For example, a treatment-provided report may be prepared, referenced by patient identity, and maintained readily accessible for a period of two years.

Upon completion of daily processing at the Headquarters, the examination and treatment data are to be routed to the Dental Research Institute. This data transmission may be accomplished via telecommunications and physical media transfer. At NDRI the data are read into the epidemiology system to develop the automated dental record for each subject. Physical media such as treatment cards will be read to provide a verification of the data electronically transmitted. These media will then be placed in temporary storage. Treatment-provided data will be used to develop the chronology and current dental status portions of the epidemiology data bases. Initially, the dental epidemiology processing will be performed by a high level statistical analysis minicomputer with high capacity hard disk storage (14). Subsequently, for long term clinical, managerial and research employment, an ANSI Mumps/COSTAR data base application is to be developed in concert with the Naval Health Research Center, San Diego. Use of the Mumps/COSTAR data base, redefined for dental applicatons, employs existing public domain software. This approach is a highly economic alternative to the considerable expenditure required for the custom development of dental epidemiology and clinical management software packages. Most importantly, system development using Mumps/COSTAR software will facilitate incorporation of the dental system into a comprehensive outpatient medical data system projected for development at NHRC.

It is anticipated that the high data storage and versatile data processing capabilities of a VAX 11/750 or equivalent minicomputer will be required for this system. It is also anticipated that, as the dental epidemiology system evolves, extensive use of DOD data communication channels will be made. This will eliminate considerable effort to design and operate a custom data communications network. Physical transfer of magnetic disk and mark-sense card media will then be employed as a data

entry check, to provide data security and preclude lost data events. This form of data communication will facilitate downloading of dental records from the NDRI dental epidemiology data base to operational dental units for ease in the maintenance of local dental files, dental recall operations and clinical management.

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Table I. Data Capture Technology for Clinical Application

Device	Limitations	Utility
Bar Code Reader	requires extensive bar code chart	portability
Custom Keyboard	system specific; requires template or key labels	rapid data entry; few are portable
Voice Recognition	user specific; limited vocabulary, response time	clerical assistant not needed
Dynamic Character Recognition	system specific; rigid document format	data entry as record is written
Digitizer	extensive program; rigid document format	good for graphics data capture
Mark-sense Card Reader	requires preprinted cards, often with limited data capacity	rapid remote site data recording; no clerical assistant
Touch Screen (beam and capacitance)	extensive program; system specific	rapid data entry; assistant may be easily trained
Touch Tablet	extensive program; devices are fragile	rapid data entry; no screen changes
Light Pen	strobe cycle, angle and position sensitive	adjunct to keyboard data entry
"Mouse"	extensive program effort; needs good eye-hand coordination	rapid entry with multiple screens

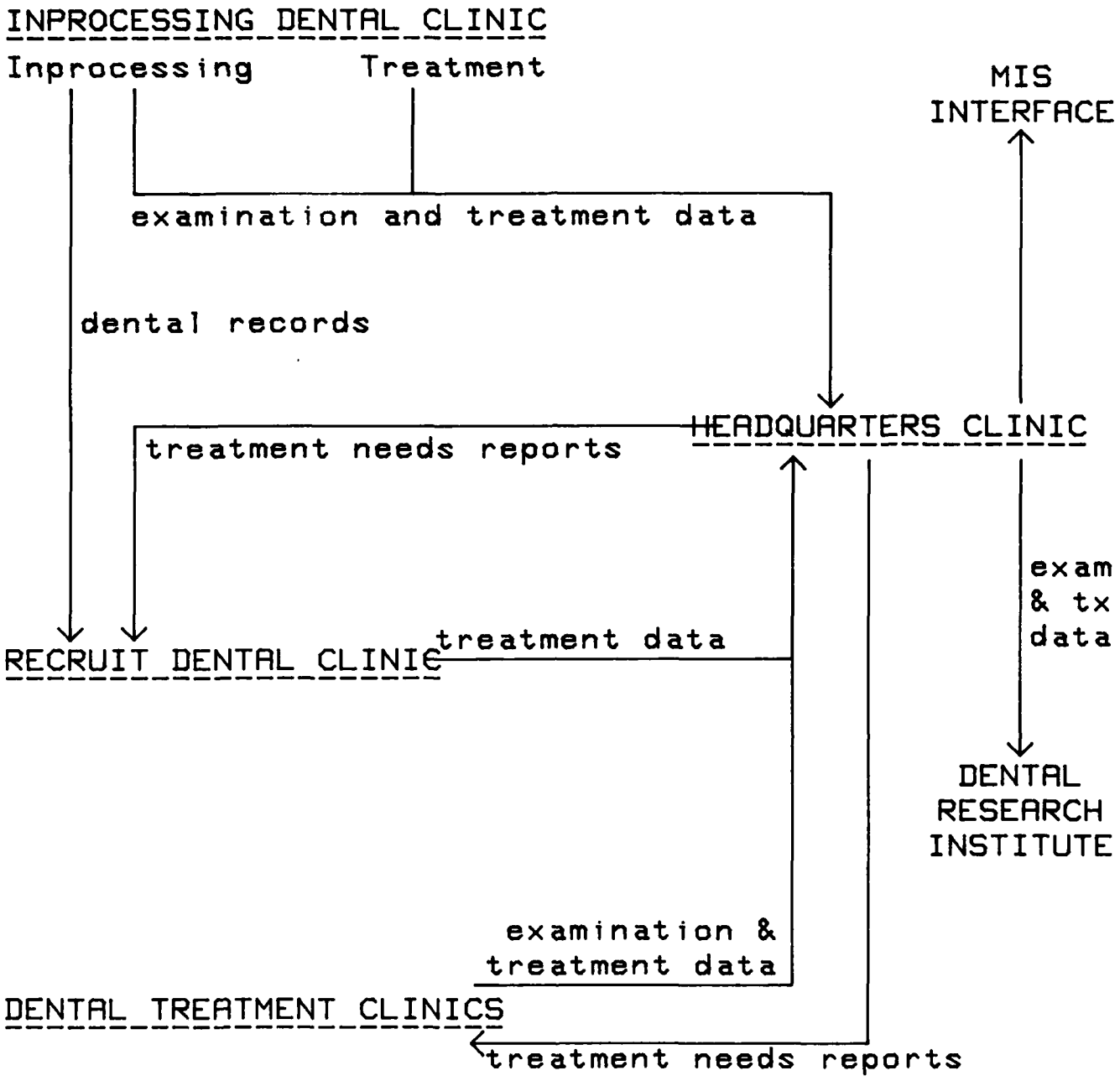


FIGURE 1. DENTAL EPIDEMIOLOGY SYSTEM FUNCTIONAL DESIGN

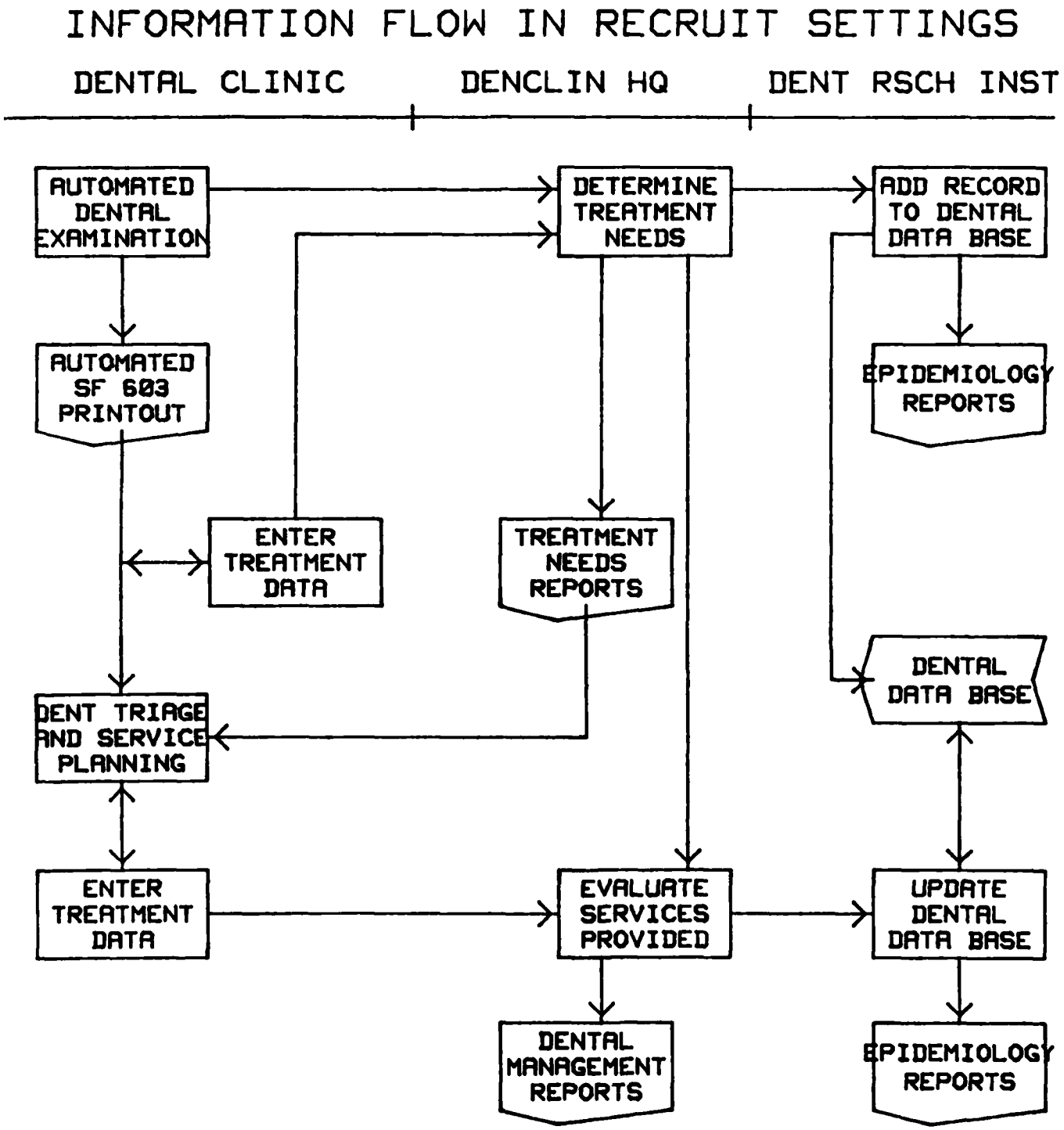

INFORMATION FLOW IN RECRUIT SETTINGS
DENTAL CLINIC
DENCLIN HQ
DENT RSCH INST
AUTOMATED DENTAL EXAMINATION
DETERMINE TREATMENT NEEDS
ADD RECORD TO DENTAL DATA BASE
AUTOMATED SF 603 PRINTOUT
EPIDEMIOLOGY REPORTS
ENTER TREATMENT DATA
TREATMENT NEEDS REPORTS
DENTAL DATA BASE
DENT TRIAGE AND SERVICE PLANNING
ENTER TREATMENT DATA
EVALUATE SERVICES PROVIDED
UPDATE DENTAL DATA BASE
DENTAL MANAGEMENT REPORTS
EPIDEMIOLOGY REPORTS

FIGURE 2.

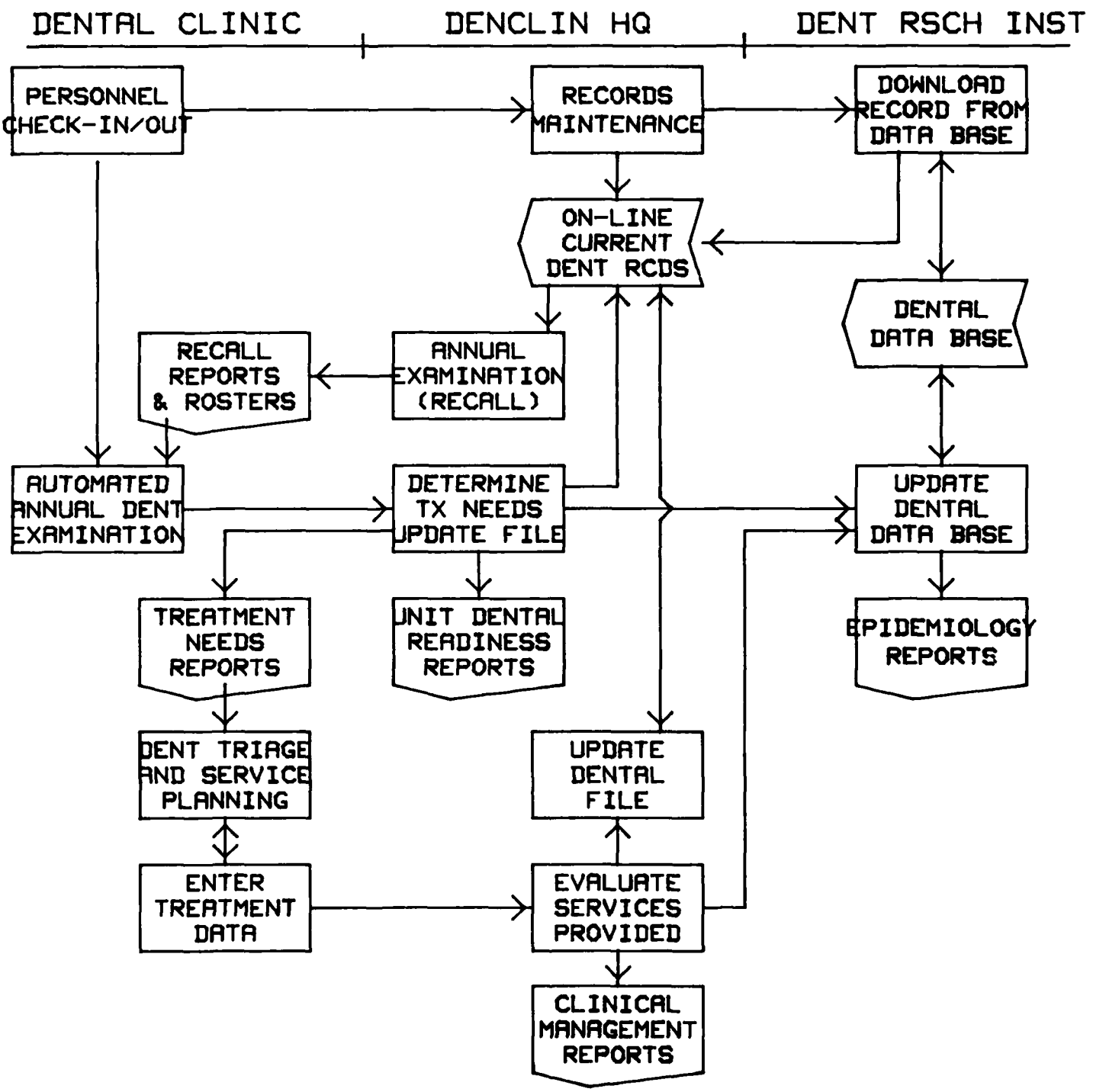

INFORMATION FLOW IN NON-RECRUIT SETTINGS
DENTAL CLINIC
DENCLIN HQ
DENT RSCH INST
PERSONNEL CHECK-IN/OUT
RECORDS MAINTENANCE
DOWNLOAD RECORD FROM DATA BASE
ON-LINE CURRENT DENT RCDS
DENTAL DATA BASE
RECALL REPORTS & ROSTERS
ANNUAL EXAMINATION (RECALL)
AUTOMATED ANNUAL DENT EXAMINATION
DETERMINE TX NEEDS UPDATE FILE
UPDATE DENTAL DATA BASE
TREATMENT NEEDS REPORTS
UNIT DENTAL READINESS REPORTS
EPIDEMIOLOGY REPORTS
DENT TRIAGE AND SERVICE PLANNING
UPDATE DENTAL FILE
ENTER TREATMENT DATA
EVALUATE SERVICES PROVIDED
CLINICAL MANAGEMENT REPORTS

FIGURE 3.

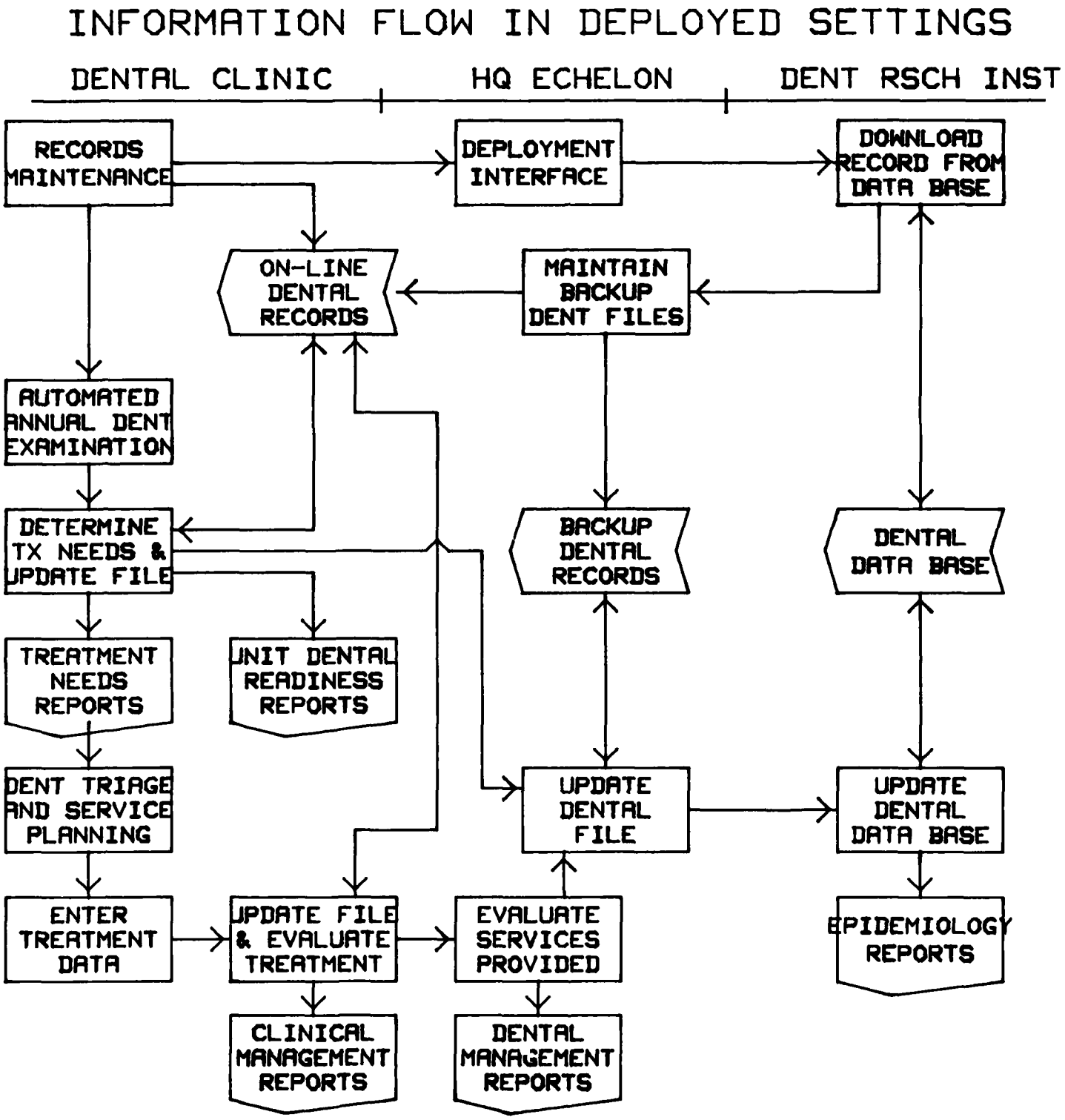

INFORMATION FLOW IN DEPLOYED SETTINGS
DENTAL CLINIC
HQ ECHELON
DENT RSCH INST
RECORDS MAINTENANCE
DEPLOYMENT INTERFACE
DOWNLOAD RECORD FROM DATA BASE
ON-LINE DENTAL RECORDS
MAINTAIN BACKUP DENT FILES
AUTOMATED ANNUAL DENT EXAMINATION
DETERMINE TX NEEDS & UPDATE FILE
BACKUP DENTAL RECORDS
DENTAL DATA BASE
TREATMENT NEEDS REPORTS
UNIT DENTAL READINESS REPORTS
DENT TRIAGE AND SERVICE PLANNING
UPDATE DENTAL FILE
UPDATE DENTAL DATA BASE
ENTER TREATMENT DATA
UPDATE FILE & EVALUATE TREATMENT
EVALUATE SERVICES PROVIDED
EPIDEMIOLOGY REPORTS
CLINICAL MANAGEMENT REPORTS
DENTAL MANAGEMENT REPORTS

FIGURE 4.

RETAIN IN DENTAL RECORD

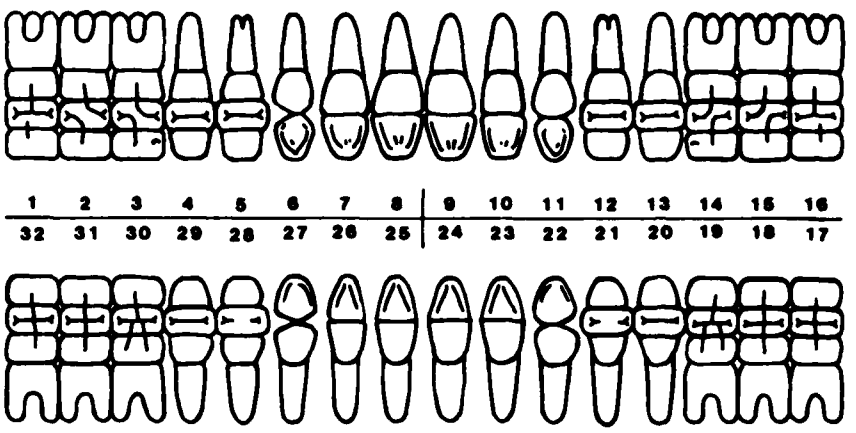
NDRI-3900/6-32(6-83)

NAVAL DENTAL CLINICS AND
NAVAL DENTAL RESEARCH INSTITUTE
GREAT LAKES IL 60088

GREAT LAKES AUTOMATED DENTAL EXAMINATION

1. PURPOSE OF EXAMINATION						2. TYPE OF EXAMINATION	3. DENTAL CLASSIFICATION
	INITIAL		SEPARATION		OTHER (Specify)		

4. MISSING TEETH AND EXISTING RESTORATIONS (PRINTOUT KEY BELOW)

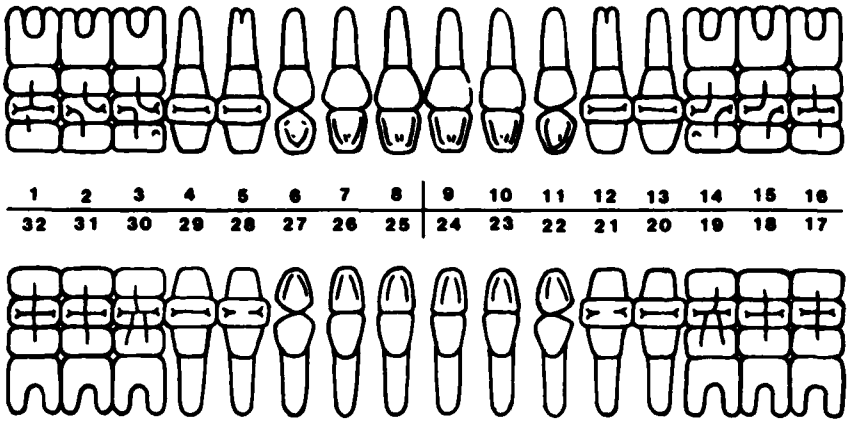


REMARKS

PLACE OF EXAMINATION | DATE

SIGNATURE OF DENTIST COMPLETING THIS SECTION

5. DISEASES, ABNORMALITIES, AND X-RAYS (PRINTOUT KEY BELOW)



A. CALCULUS

B. PERIODONTOCLASIA

C. STOMATITIS (Specify)

D. DENTURES NEEDED

ABNORMALITIES OF OCCLUSION -REMARKS

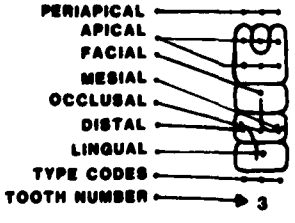
INDICATE X-RAYS USED IN THIS EXAMINATION

DATE	PLACE OF EXAMINATION	SIGNATURE OF DENTIST COMPLETING THIS SECTION

PATIENT'S LAST NAME -FIRST NAME -MIDDLE NAME	ORGANIZATION UNIT	IDENTIFICATION NO.

FOLD UNDER FOR SF603 PATIENT INFORMATION

DENTAL PRINTOUT ZONES



PRINTOUT KEY

SECTION 4.

* Indicates surface restored

TYPE CODES
A : AMALGAM
R : RESIN
T : TEMPORARY
M : MISSING

PERIAPICAL
RPD/FPD (Standard)
\# : Abutment tooth

APICAL
RCF (Standard)
G : Gutta percha
S : Silver point

CODE COMBINATIONS POSSIBLE

SECTION 5.

* Indicates surface to be restored

TYPE CODES
A : Minimal lesion
B : Moderate lesion
C : Advanced lesion
U : Critical lesion

OTHER NOTES IN "REMARKS"

PERIAPICAL
I : Impacted/unerupted
L : Radiolucency
O : Radiopacity
R : Retained root(s)

APICAL (Tx Recommended)
RCT : Endodontics
PER : Periodontal
EXT : Extraction

RETAIN IN DENTAL RECORD

Figure 5.

DENTAL TREATMENT NEEDS PROFILE UNIT: DATE:

TREATMENT AREA	PTNT SITTINGS PTY	RTN	TOT	PROCEDURES PTY	RTN	TOT	EST TX HRS PTY	RTN	TOT
DX/PD/PER	999	999	999	999	999	999	999	999	999
EXAM/DX	999	999	999	999	999	999	999	999	999
OHI	999	999	999	999	999	999	999	999	999
PROPH/F2	999	999	999	999	999	999	999	999	999
PERIO	999	999	999	999	999	999	999	999	999
OTHER TX	999	999	999	999	999	999	999	999	999
RESTORATIVE	999	999	999	999	999	999	999	999	999
EX/CONS	999	999	999	999	999	999	999	999	999
A-LESIONS	999	999	999	999	999	999	999	999	999
B-LESIONS	999	999	999	999	999	999	999	999	999
C-LESIONS	999	999	999	999	999	999	999	999	999
U-LESIONS	999	999	999	999	999	999	999	999	999
OTHER TX	999	999	999	999	999	999	999	999	999
ENDODONTICS	999	999	999	999	999	999	999	999	999
EX/CONS	999	999	999	999	999	999	999	999	999
R C T	999	999	999	999	999	999	999	999	999
OTHER TX	999	999	999	999	999	999	999	999	999
PROSTHETICS	999	999	999	999	999	999	999	999	999
EX/CONS	999	999	999	999	999	999	999	999	999
ANT REPL	999	999	999	999	999	999	999	999	999
POST REPL	999	999	999	999	999	999	999	999	999
CROWNS	999	999	999	999	999	999	999	999	999
F/F DENTURE	999	999	999	999	999	999	999	999	999
OTHER TX	999	999	999	999	999	999	999	999	999
ORAL SURGERY	999	999	999	999	999	999	999	999	999
EX/CONS	999	999	999	999	999	999	999	999	999
ORTHOG CONS	999	999	999	999	999	999	999	999	999
RET ROOTS	999	999	999	999	999	999	999	999	999
SIMP EXTR	999	999	999	999	999	999	999	999	999
COMPL EXTR	999	999	999	999	999	999	999	999	999
IMPACTIONS	999	999	999	999	999	999	999	999	999
OTHER TX	999	999	999	999	999	999	999	999	999
* UNIT TOTALS *	999	999	999	999	999	999	999	999	999

UNIT DENTAL PROFILE	PRIORITY PTS NMBR	PRCNT	ROUTINE PTS NMBR	PRCNT	TOTAL PTS NMBR	PRCNT
CLASS 1	99	99	99	99	99	99
CLASS 2	99	99	99	99	99	99
CLASS 3	99	99	99	99	99	99
CLASS 4	99	99	99	99	99	99

FIGURE 6. GROUP DENTAL PROFILE

TREATMENT NEEDS: PRIORITY PATIENTS UNIT: DATE:

SOC SEC NO	NAME	TREATMENT NEED	PROC	EST HRS
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
		*** PATIENT TOTL ***	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
		*** PATIENT TOTL ***	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
		XXXXXXXXXXXXXXXXXXX	99	99
		*** PATIENT TOTL ***	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
		XXXXXXXXXXXXXXXXXXX	99	99
		*** PATIENT TOTL ***	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
		XXXXXXXXXXXXXXXXXXX	99	99
		XXXXXXXXXXXXXXXXXXX	99	99
		*** PATIENT TOTL ***	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
		XXXXXXXXXXXXXXXXXXX	99	99
		XXXXXXXXXXXXXXXXXXX	99	99
		*** PATIENT TOTL ***	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
		XXXXXXXXXXXXXXXXXXX	99	99
		XXXXXXXXXXXXXXXXXXX	99	99
		XXXXXXXXXXXXXXXXXXX	99	99
		*** PATIENT TOTAL ***	99	99

FIGURE 7. INDIVIDUAL TREATMENT NEEDS

CRITICAL TREATMENT NEEDS: ROUTINE PTS UNIT: DATE:

SOC SEC NO	NAME	TREATMENT NEED	PROC	EST HRS
DIAGNOSIS/PREVENTIVE/PERIODONTICS				
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
RESTORATIVE				
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
ENDODONTICS				
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
PROSTHETICS				
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
ORAL SURGERY				
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
	*** UNIT TOTALS ***		999	999

FIGURE 8. CRITICAL TREATMENT NEEDS

CONSULT ROSTER: PRIORITY PATIENTS UNIT: DATE:

SOC SEC NO	NAME	OBSERVATION	PROC	EST HRS
MEDICAL				
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
DIAGNOSIS				
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
PERIODONTICS				
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
RESTORATIVE				
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
ENDODONTICS				
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
PROSTHETICS				
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
ORAL SURGERY				
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99
999 99 9999	XXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXX	99	99

FIGURE 9. UNIT CONSULT ROSTER

SIGNIFICANT MEDICAL HX: ROUTINE PTS UNIT: DATE:

SOC SEC NO	NAME	MEDICAL OBSERVATION
999 99 9999	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
999 99 9999	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
999 99 9999	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
999 99 9999	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
999 99 9999	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
999 99 9999	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
999 99 9999	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
999 99 9999	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
999 99 9999	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
999 99 9999	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
999 99 9999	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
999 99 9999	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXXXX

FIGURE 10. SIGNIFICANT MEDICAL HISTORY REPORT

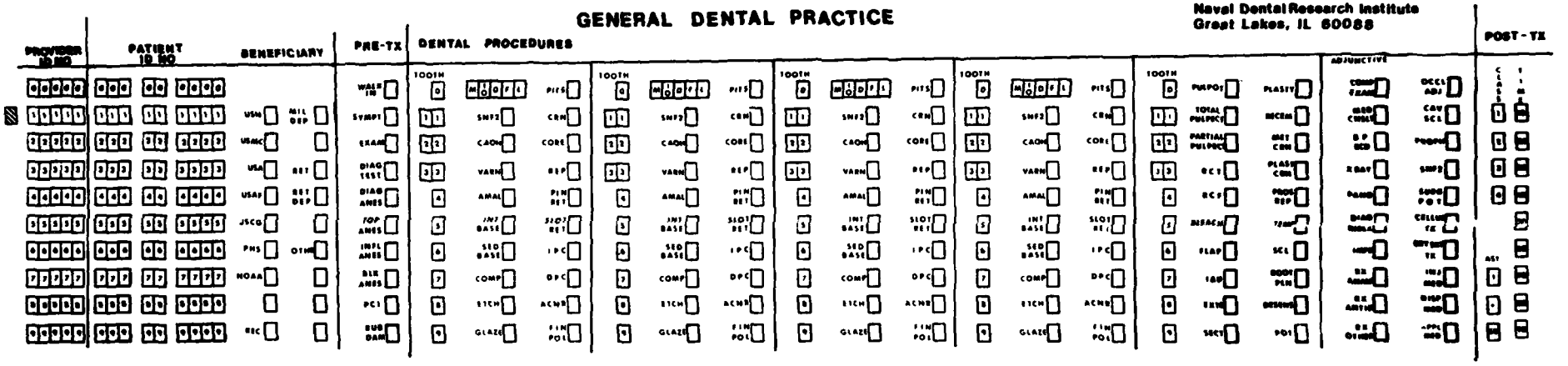

GENERAL DENTAL PRACTICE
Naval Dental Research Institute
Great Lakes, IL 60088
PROVIDER ID NO
PATIENT ID NO
BENEFICIARY
PRE-TX
DENTAL PROCEDURES
POST-TX

FIGURE 11.

DAILY TREATMENT LOG DATE:

PROVIDER: NUMBER:

PATIENT SSN	PATIENT NAME	SERVICES PROVIDED	CLASS
999 99 9999	XXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXX	9
999 99 9999	XXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXX	9
999 99 9999	XXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXX	9
999 99 9999	XXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXX	9
999 99 9999	XXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXX	9
999 99 9999	XXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXX	9
999 99 9999	XXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXX	9
999 99 9999	XXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXX	9
999 99 9999	XXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXX	9

FIGURE 12. PROVIDER DAILY LOG

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REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
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	6. PERFORMING ORG. REPORT NUMBER NDRI-PR 84-07
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18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Digital computers,
Dental examination,
Dental record,
Dental treatment,
Data base

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

The previous functional design for the epidemiology system was modified in response to changes in the operating environment. The current design uses microcomputers located in critical data processing areas of the clinical and command environment. Both provide economy and flexibility to this design. Data from dental inprocessing and annual examinations are to be processed in the clinical headquarters to provide treatment-need reports. The automated examination data are to be subsequently forwarded to

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NDRI for epidemiology processing. Treatment provided data are to be collected in the clinic via mark-sense card, processed in the Headquarters and likewise forwarded to NDRI for updating the dental data base. A dedicated minicomputer, using the ANSI MUMPS language and the COSTAR medical data base is adequate for epidemiologic data processing. The MUMPS/COSTAR data base also appears to be the most cost effective approach to clinical management data processing. Originator supplied keywords include:

(Block 19)

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